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# 2SK2800

Silicon N Channel MOS FET
High Speed Power Switching

HITACHI

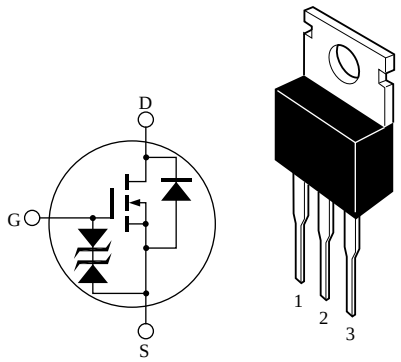
ADE-208-513G (Z)
8th. Edition
Jun 1998

## Features

- Low on-resistance
  $R_{DS(on)}$ = 15 mΩ typ.
- High speed switching
- Low drive current
- 4V gate drive device can be driven from 5V source

## Outline

TO–220AB




1. Gate
2. Drain (Flange)
3. Source

Hitachi semiconductor

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## Absolute Maximum Ratings (Ta = 25°C)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to source voltage | $V_{DSS}$ | 60 | V |
| Gate to source voltage | $V_{GSS}$ | ±20 | V |
| Drain current | $I_D$ | 40 | A |
| Drain peak current | $I_{D(pulse)}$ Note1 | 160 | A |
| Body-drain diode reverse drain current | $I_{DR}$ | 40 | A |
| Avalanche current | $I_{AP}$ Note 3 | 40 | A |
| Avalanche energy | $E_{AR}$ Note 3 | 137 | mJ |
| Channel dissipation | Pch Note 2 | 50 | W |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

Note: 1. PW ≤ 10µs, duty cycle ≤ 1 %
2. Value at Tc = 25°C
3. Value at Tch = 25°C, Rg ≥ 50Ω

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## Electrical Characteristics (Ta = 25°C)

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 60 | — | — | V | $I_D$ = 10mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | ±20 | — | — | V | $I_G$ = ±100µA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS}$ | — | — | ±10 | µA | $V_{GS}$ = ±16V, $V_{DS}$ = 0 |
| Zero gate voltege drain current | $I_{DSS}$ | — | — | 10 | µA | $V_{DS}$ = 60 V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | 1.5 | — | 2.5 | V | $I_D$ = 1mA, $V_{DS}$ = 10V |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 15 | 20 | mΩ | $I_D$ = 20A, $V_{GS}$ = 10V Note4 |
| | $R_{DS(on)}$ | — | 25 | 40 | mΩ | $I_D$ = 20A, $V_{GS}$ = 4V Note4 |
| Forward transfer admittance | $\|y_{fs}\|$ | 20 | 35 | — | S | $I_D$ = 20A, $V_{DS}$ = 10V Note4 |
| Input capacitance | Ciss | — | 1500 | — | pF | $V_{DS}$ = 10V |
| Output capacitance | Coss | — | 720 | — | pF | $V_{GS}$ = 0 |
| Reverse transfer capacitance | Crss | — | 200 | — | pF | f = 1MHz |
| Turn-on delay time | $t_{d(on)}$ | — | 20 | — | ns | $I_D$ = 20A, $R_L$ = 1.5Ω |
| Rise time | $t_r$ | — | 180 | — | ns | $V_{GS}$ = 10V |
| Turn-off delay time | $t_{d(off)}$ | — | 200 | — | ns | |
| Fall time | $t_f$ | — | 200 | — | ns | |
| Body–drain diode forward voltage | $V_{DF}$ | — | 0.95 | — | V | $I_F$ = 40A, VGS = 0 |
| Body–drain diode reverse recovery time | $t_{rr}$ | — | 70 | — | V | $I_F$ = 40A, VGS = 0<br>diF/ dt =50A/µs |

Note: 4. Pulse test

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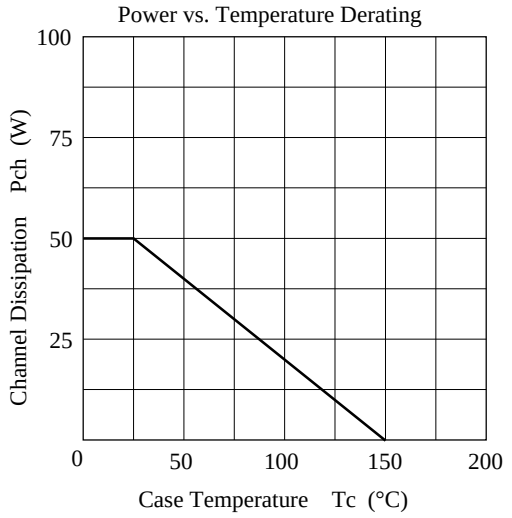
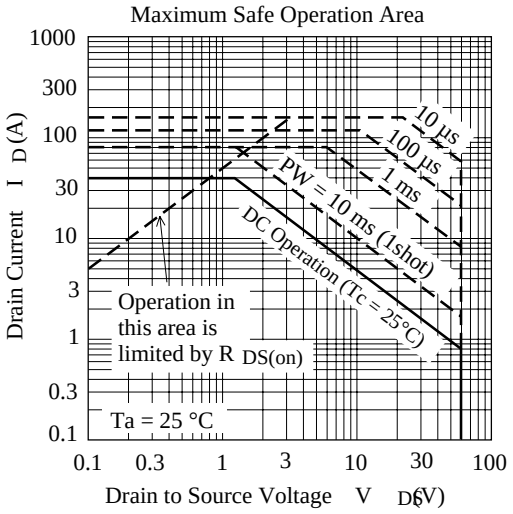
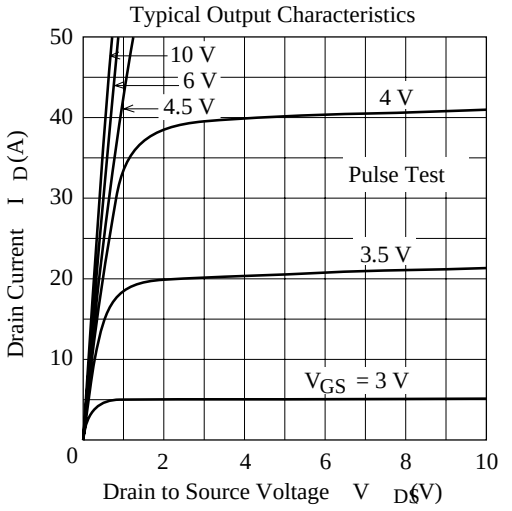
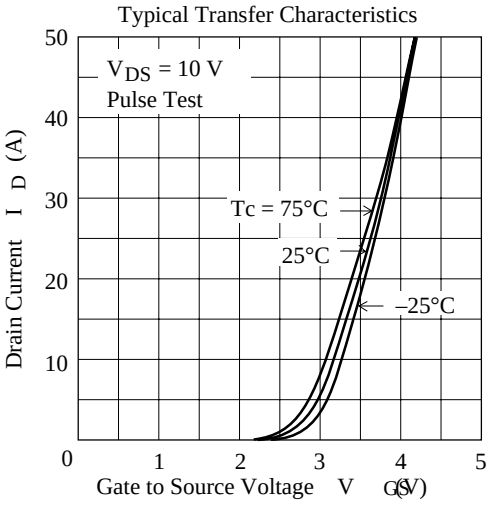
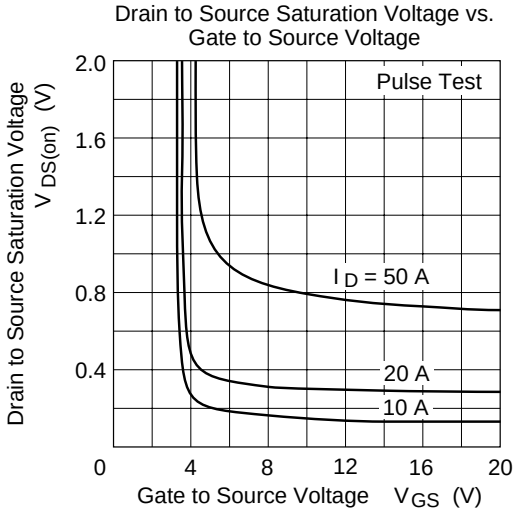
## Main Characteristics

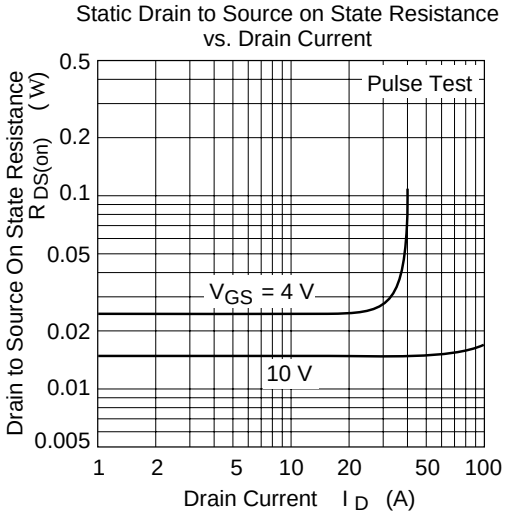


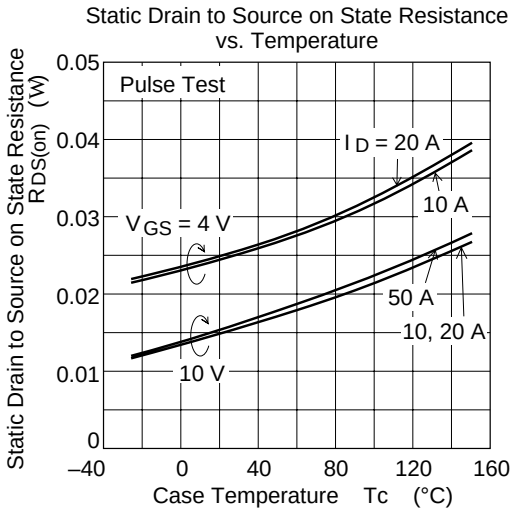



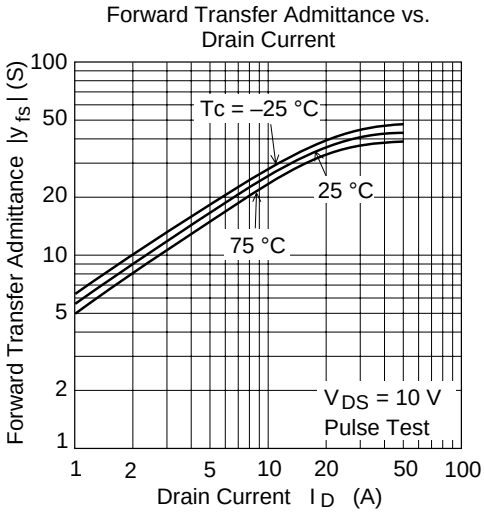




Drain to Source Saturation Voltage vs.
Gate to Source Voltage
Pulse Test
I D = 50 A
20 A
10 A
Drain to Source Saturation Voltage
V DS(on) (V)
2.0
1.6
1.2
0.8
0.4
0
4
8
12
16
20
Gate to Source Voltage V GS (V)


Static Drain to Source on State Resistance
vs. Drain Current
Pulse Test
V GS = 4 V
10 V
Drain to Source On State Resistance
R DS(on) (W)
0.5
0.2
0.1
0.05
0.02
0.01
0.005
1
2
5
10
20
50
100
Drain Current I D (A)


Static Drain to Source on State Resistance
vs. Temperature
Pulse Test
I D = 20 A
10 A
V GS = 4 V
50 A
10, 20 A
10 V
Static Drain to Source on State Resistance
RDS(on) (W)
0.05
0.04
0.03
0.02
0.01
0
–40
0
40
80
120
160
Case Temperature Tc (°C)


Forward Transfer Admittance vs.
Drain Current
Tc = –25 °C
25 °C
75 °C
V DS = 10 V
Pulse Test
Forward Transfer Admittance |y fs| (S)
100
50
20
10
5
2
1
1
2
5
10
20
50
100
Drain Current I D (A)

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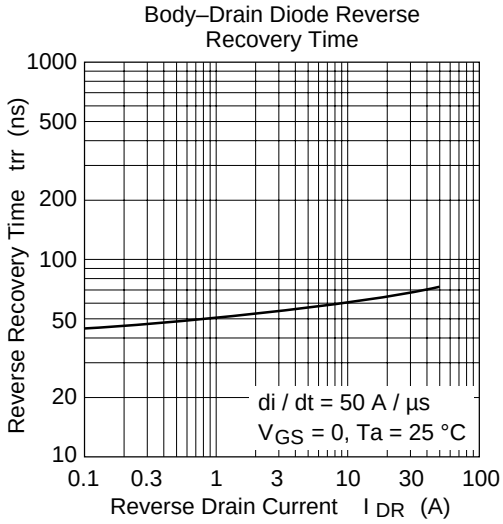
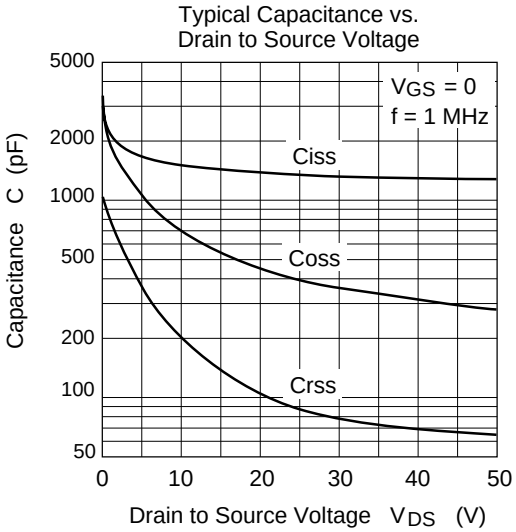
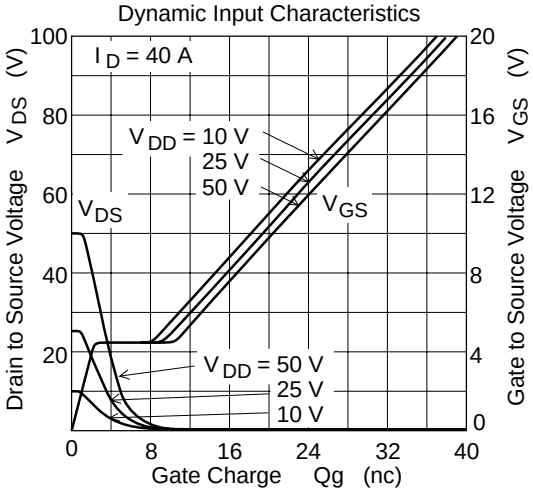
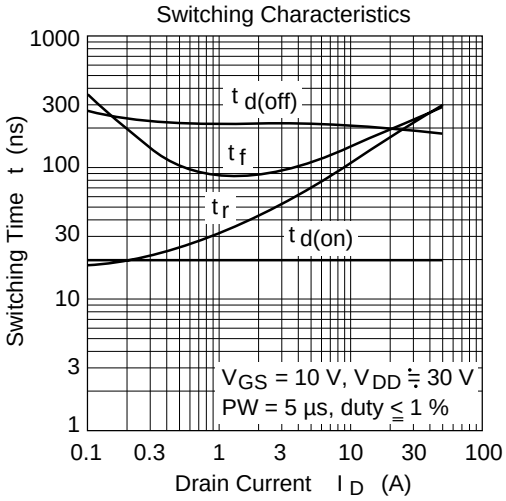
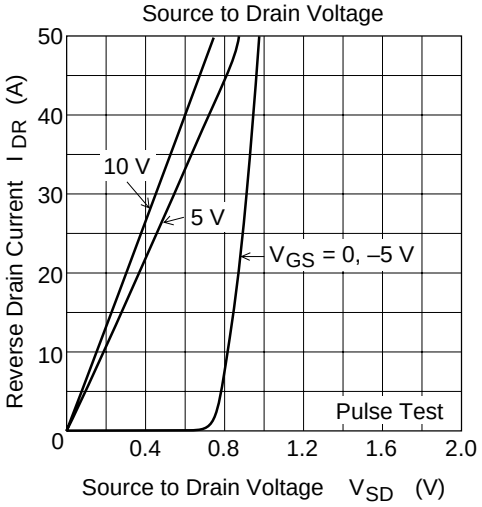


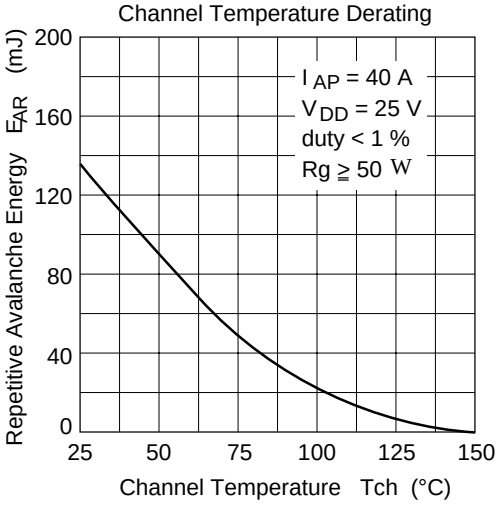



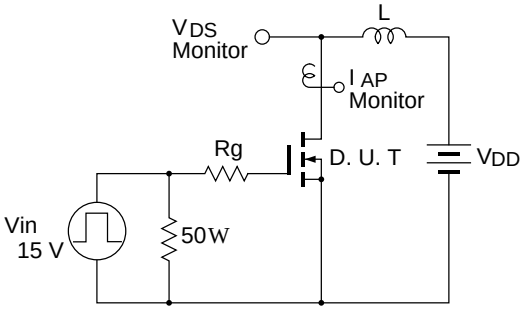
Reverse Drain Current vs.
Source to Drain Voltage




Maximum Avalanche Energy vs.
Channel Temperature Derating

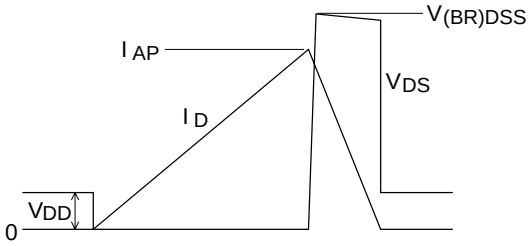


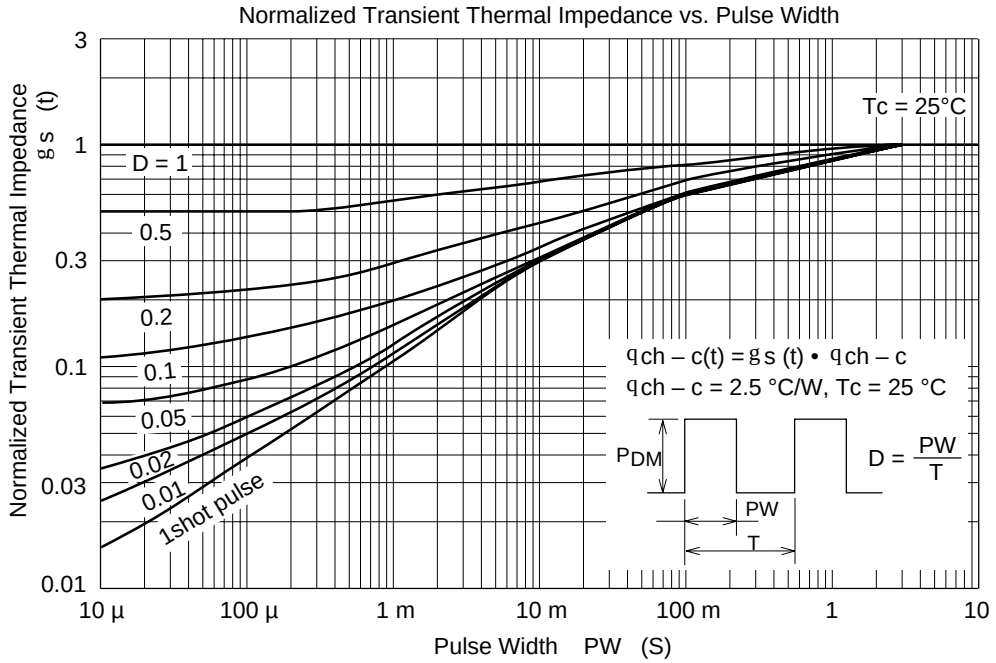

Avalanche Test Circuit

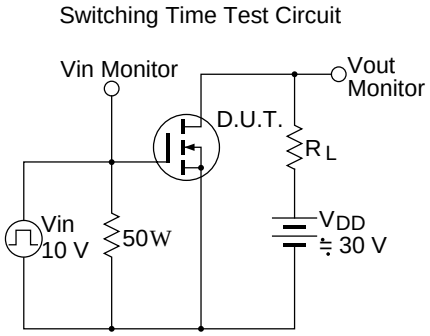


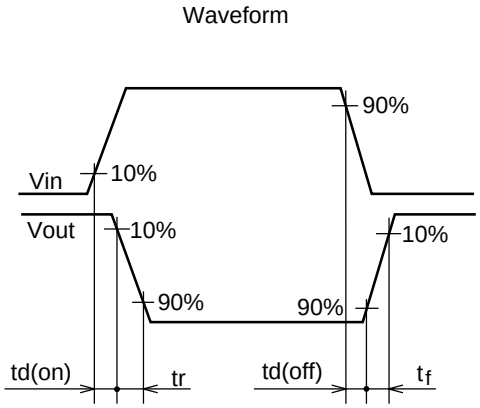

Avalanche Waveform

$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^{2} \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$




Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance
g s (t)
3
1
0.3
0.1
0.03
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
ɥch – c(t) = ɡs (t) • ɥch – c
ɥch – c = 2.5 °C/W, Tc = 25 °C
PDM
D = PW/T
PW
T
10 µ
100 µ
1 m
10 m
100 m
1
10
Pulse Width PW (S)


Switching Time Test Circuit
Vin Monitor
Vout
Monitor
D.U.T.
RL
Vin
10 V
50W
VDD
≒ 30 V


Waveform
90%
Vin
10%
Vout
10%
10%
90%
90%
td(on)
tr
td(off)
tf

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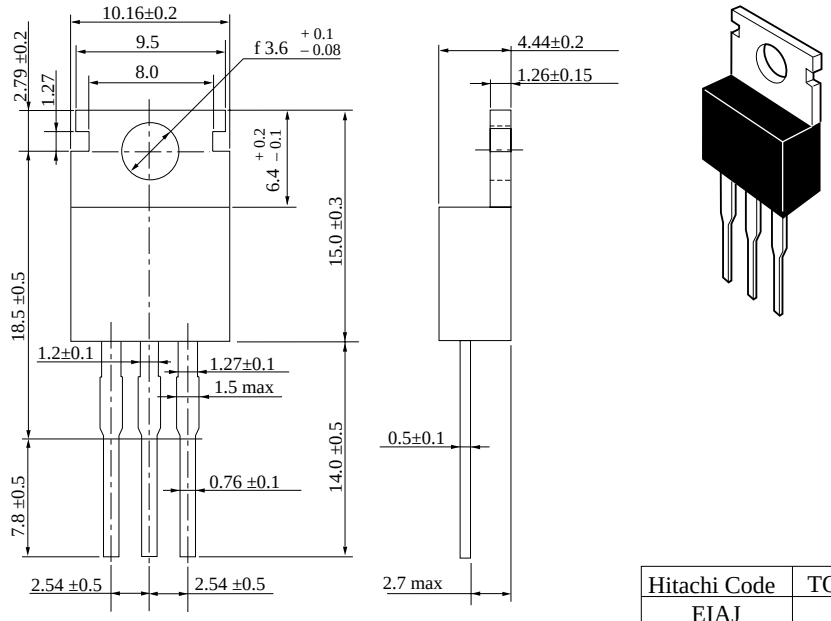
## Package Dimensions

**Unit: mm**

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|---|---|
| Hitachi Code | TO–220AB |
| EIAJ | SC–46 |
| JEDEC | — |

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